

Environmental Management Cooperative Agreements: The Partnership between NETL and the Energy & Environmental Research Center

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Introduction

The Energy & Environmental Research Center (EERC) is a nonprofit research, development, demonstration, and commercialization unit of the University of North Dakota. The EERC has an established record of developing partnerships with industry, government, and academia focused on commercializing cost-effective, practical energy and environmental technologies. An example of this is the two Cooperative Agreements between the U.S. Department of Energy (DOE) National Energy Technology Laboratory (NETL) and the EERC. These Cooperative Agreements have resulted in numerous accomplishments for the Environmental Management (EM) Program over the last seven years. Future work will build on the experience of the first Cooperative Agreement and be conducted through the second Cooperative Agreement, the Environmental Technology Acceptance (ETA) Program.

Problem Definition

Commercialization of detection, characterization, and cleanup technologies can be limited for many reasons, including a lack of testing and demonstration capabilities, the resolution of technical issues outside the traditional focus of the technology developer, limited capital, and only rudimentary knowledge of DOE and EM site needs. Deployment of a technology in the highly competitive EM marketplace requires sound field test data that clearly demonstrate the technology's advantages over the baseline, knowledge of personnel and site cleanup plans, and the potential to incorporate the technology into the ongoing site cleanup activities with minimal disruption.

Successful implementation of the DOE EM Program's 2006 Plan requires the timely deployment of cost-effective, efficient, and safe cleanup technologies within the DOE complex. The EERC's Cooperative Agreements with DOE NETL have expedited and continue to accelerate technology

deployment through a combination of services, including technical support, demonstrations, and brokering.

Program Description

Experience gained during the first Cooperative Agreement was used to develop the EERC's current program, the ETA Program. The ETA was initiated in FY2001 to continue the EERC's efforts to help DOE meet its 2006 cleanup goals through the accelerated development and deployment of safe, cost-effective, and efficient technologies that meet some of the most pressing needs at the weapons complex sites. The ETA process consists of analysis and prioritization of the complexwide needs, matching appropriate technologies with high-priority needs, and accelerating the development of the technologies so that they can be used to meet the needs. The EERC enhances technology development through a combination of services that include technical support, demonstrations, and brokering. A key aspect of the ETA is that each of these steps is taken with the agreement of the end users.

Accomplishments and Future Activities

While the ETA Program offers an efficient method of helping DOE solve the most pressing needs at the weapons complex sites, its success is ensured by four core principles: addressing emerging complexwide topics, nurturing partnerships with private industry partners, addressing broad research topics that span several needs and/or locations, and developing intellectual property for commercialization. These core principles can be found in the current ETA activities.

Addressing Emerging Complexwide Topics

Two projects that are under development in the ETA Program are a long-term stewardship (LTS) activity and creation of a Web-based information system that matches available technologies with needs for the various EM Focus Areas.

The LTS project was originally proposed in response to specific needs at the Mound site in Miamisburg, Ohio, but because the needs exist at other locations as well, the flexibility of the ETA Program permits the scope of work to be adapted to encompass the same types of needs at other sites within the weapons complex. The EERC serves on the Project Management Team of the LTS Initiative for the Miamisburg Environmental Management Project (MEMP). In this capacity, the EERC will assist MEMP in its assessment of site needs for institutional controls, information management, and long-term monitoring and characterization activities. Technologies that may help to fulfill these needs will also be screened. The EERC is relating the gathered information for the Mound initiative to other sites through the assessment of complexwide LTS needs and the demonstration and evaluation of prospective technologies for the Mound site.

The Web-based information system was originally designed as a decision-making tool to provide users with a means of matching potential technologies with needs within the Deactivation and Decommissioning Focus Area. The system is based on a hierarchical classification model

consisting of three tiers. The tiers are based upon assessments of the need or technology in terms of problem area, media, and contamination/remediation objective. Needs and technologies are matched using an algorithm based upon these classifiers. In addition to relating needs and technologies, the system can identify needs without technologies as well as technologies that apply to multiple, complexwide needs. Because of its applicability to the other focus areas, the system is being expanded to address the needs of all of the other focus areas and will be called the National Focus Area Information System.

Nurturing Partnerships

As the EERC continues to search for cost-effective technologies that can be applied in the EM arena, partnerships that have been built with various private companies enable additional technologies to be tapped that might otherwise go unnoticed or unmatched with a need. One such partnership is between the EERC and ADA Technologies, Inc. (ADA), of Englewood, Colorado. The EERC worked with ADA in the past, demonstrating an enhanced carbon-based sorbent that removed mercury from Outfall 200 at Oak Ridge National Laboratory's Y-12 plant to ultralow (i.e., <12 ppt) levels. Continuing contact with ADA informed personnel at the EERC of ADA's recent success in photocatalytic oxidation of dissolved mercury. In concert with the EERC, ADA is developing the technology for use at various weapons complex sites (notably Oak Ridge) to remove mercury from aqueous streams. Development activities that are under way at the EERC include a detailed characterization of the sorbent materials using scanning electron microscopy coupled with energy-dispersive spectrometry and x-ray diffraction techniques as well as verification of mercury removal efficiencies under a variety of loading conditions during laboratory tests using surrogate waste streams to verify previous test results and to provide additional treatment efficiency data to supplement the existing database.

Addressing Broad Research Topics

Vegetation as a cleanup tool is being applied more frequently in various remediation scenarios. Two examples are the use of plants to phytoextract metals from contaminated soils and vegetative covers as alternatives to clay or geomembrane caps. The EERC has been involved with two EM projects in which natural vegetative processes were applied to needs within the EM complex. During the previous Cooperative Agreement, the EERC worked with Phytokinetics, Inc., to evaluate three methods for processing plant materials that had been used to phytoremediate lead-contaminated soil. Cofiring with coal, composting, and liquid extraction were investigated. The EERC's study showed that cofiring reduced the volume of lead-contaminated material by 90 wt%. The extraction tests showed that over 98 wt% of the lead could be extracted using a chelating agent.

Under the ETA, the EERC is working with Ecolotree, Inc., of North Liberty, Iowa, to design a vegetative cover to prevent percolation of water through a low-level waste (LLW) repository at the Savannah River Site. Quick-growing indigenous vegetation having high transpiration rates will be integrated with late-succession vegetation having similar characteristics into the design of a "Century Cap" that will be effective for at least one hundred years, be compatible with humid environmental conditions, and require minimal maintenance. To date, specific needs of vegetative covers (both in humid and arid environments) are being defined, data regarding the site and specific plant species to be included in the design are being gathered, and the Hydrus-2D

groundwater model has been acquired for manipulation of design and monitoring data. Project activities will also include evaluations of both the cost of a vegetative cover and the transferability of the technology to other LLW repositories at Nevada, Idaho, and Los Alamos.

Developing Intellectual Property for Commercialization

The use of subcritical water extraction as a treatment for polychlorinated biphenyl- (PCB-) and lead-contaminated paint chips produced during deactivation and decommissioning (D&D) activities is being further developed under the ETA. The subcritical water treatment technology was developed at the EERC originally as a soil remediation technology and recently demonstrated for treating explosives-contaminated soils. Its flexibility also enables it to be applied to the regulatory-compliant disposal of PCB-, heavy metal-, and radionuclide-contaminated paint wastes created during D&D activities. ETA activities include determining the best application of the technology to this use; i.e., is it more effective to 1) selectively remove PCBs from the bulk paint matrix, thereby generating separate PCB- and radioactively contaminated wastes that would then be disposed of in a conventional manner or 2) dechlorinate PCBs in the bulk paint matrix so that the total PCB concentration is reduced below the levels of concern.

Benefits

The EERC has an established record of developing partnerships with industry, government, and academia focused on commercializing cost-effective, practical energy and environmental technologies. Two Cooperative Agreements between DOE NETL and the EERC are examples of a partnership that has resulted in numerous EM Program successes during the past seven years. Under the first of the agreements, the EERC aided the development of 16 innovative technologies at an average cost of less than \$0.5M per technology.

Summary

Under the NETL–EERC EM Cooperative Agreement, the EERC contributes technical expertise and facilities as well as familiarity with the EM Program to speed up the development, commercialization, and deployment of various innovative monitoring and cleanup technologies. Through the four core principles of addressing emerging complexwide topics, nurturing partnerships with private industry partners, addressing broad research topics that span several needs and/or locations, and developing intellectual property for commercialization, the ETA is addressing pressing EM complex needs while advancing cutting-edge technologies. As embodied in the ETA, the EERC–NETL Cooperative Agreement partnership is assisting DOE in meeting its 2006 cleanup goals.

Acknowledgments

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Industry Partnerships to Deploy Environmental Technology Conference
National Energy Technology Laboratory, Morgantown, West Virginia

Dr. Robert C. Bedick, Product Manager, Industry Programs
Dr. Edgar B. Klunder, Program Manager, Environmental Management



EERC Partnership Methods

- Provide expertise and technical resources to the private sector for technology commercialization
- Develop new technologies using in-house research, development, and demonstration that lead to commercialization partnerships with the private sector

An aerial photograph of sand dunes at sunset. The sky is a gradient of yellow and orange, and the sand dunes are illuminated with warm, golden light, creating a textured, undulating landscape.

Environmental Technology Assistance (ETA) Program

The EERC helps DOE meet its 2006 cleanup goals through the development of safe, cost-effective, and efficient technologies by

- Matching emerging technologies with EM needs.
- Assisting industry partners through testing, demonstration, and deployment of their technologies.
- Working with end-users.

Current ETA Programs and Partners

- Long-term stewardship at Mound Plant Site in Ohio (*as a team member for the Long-Term Stewardship Initiative for the Miamisburg Environmental Management Project*)
- Photocatalytic processing of mercury-contaminated water (*with ADA Technologies, Inc., of Denver, CO*)
- Demonstration of EERC-patented subcritical water treatment technology for the decontamination of paint wastes from D&D activities
- Development of a vegetative cover design for a low-level waste repository at Savannah River site (*with Ecolotree, Inc., of Iowa City, IA*)
- Conversion of EERC-developed D&D Focus Area Information System to a Web-based platform

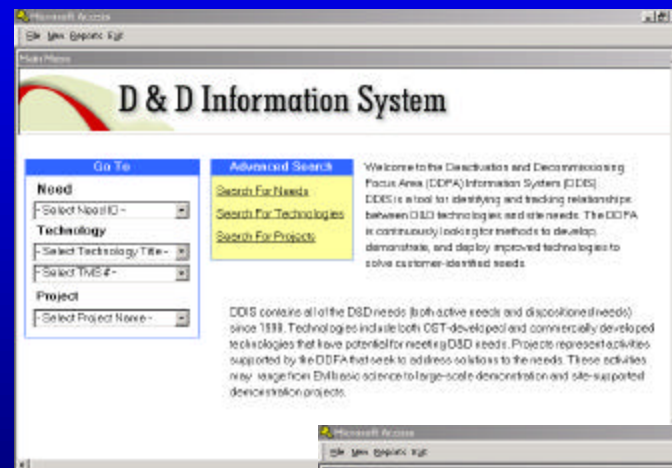
ETA Emphasizes the Development of

- Emerging complex wide strategies.
- Partnerships.
- Intellectual property for commercialization.
- Research topics.

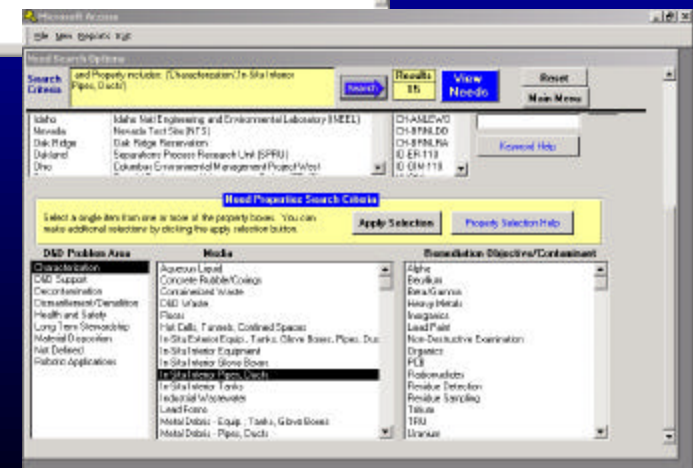
Development of Emerging Strategies



LTS



D&D Focus Area
Information System



Development of Partnerships



A 1997 project with ADA used a proprietary sorbent to remove mercury from a creek at Oak Ridge National Laboratory to ultralow levels.

The current project with ADA is the development of a photocatalytic method of removing mercury from aqueous streams.

ADA
TECHNOLOGIES, INC

Development of Intellectual Property for Commercialization

Demonstrations of the EERC-patented subcritical water treatment technology are ongoing using samples of contaminated paint from the CMS Energy facility in Charlevoix, Michigan. This technology could be used to treat contaminated paint wastes from D&D activities.

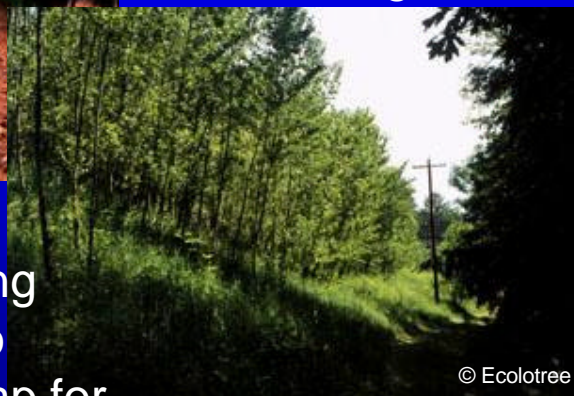


Development of Research Topics



Vegetative caps are relatively low-cost methods of limiting water infiltration and leaching at landfill sites.

The EERC is partnering with Ecolotree, Inc., to design a vegetative cap for a LLW repository at the Savannah River Site.



During FY'99-'00, the EERC studied processes that could treat sunflowers that had been used to phytoremediate lead-contaminated soil.

